

(19) World Intellectual Property
Organization
International Bureau



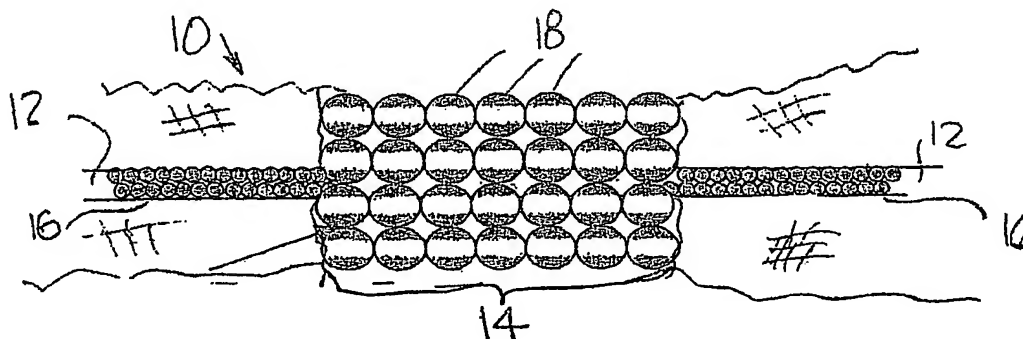
(43) International Publication Date
3 June 2004 (03.06.2004)

PCT

(10) International Publication Number
WO 2004/046495 A2

- (51) International Patent Classification⁷: E21B
- (21) International Application Number:
PCT/US2003/037252
- (22) International Filing Date:
18 November 2003 (18.11.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/427,134 18 November 2002 (18.11.2002) US
- (71) Applicant (for all designated States except US): SAUDI ARABIAN OIL COMPANY [SA/SA]; R-3296, Administration Building, Dhahran 31311 (SA).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): ORTIZ, Isaias [US/SA]; 101 Banyan Court, Dhahran 31311 (SA). THOMAS, Ronnie, L. [US/SA]; 100 Cactus CT, Dhahran 31311 (SA).
- (74) Agent: SPATH, Thomas, E.; Abelman, Frayne & Schwab, 150 East 42nd Street, New York, NY 10017-5612 (US).
- (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (regional): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:
— without international search report and to be republished upon receipt of that report
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD OF TREATING SUBTERRANEAN FORMATIONS TO ENHANCE HYDROCARBON PRODUCTION USING PROPPANTS



(57) Abstract: A method of enhancing the flow of hydrocarbon fluids from small flow conduits in a subterranean reservoir rock formation that have traditionally not been propped in association with a fracturing treatment of the formation, the method including the steps of introducing a first pressurized fluid into the formation at a pressure that is sufficient to expand the pre-existing small flow conduits and introducing into the pressure-expanded small flow conduits a first portion of a relatively small particulate propping agent; simultaneously with the fracturing of the formation, or immediately thereafter, introducing a second portion of a relatively small particulate propping agent into expanded pre-existing small flow conduits and into any new small flow conduits that are formed by the fracturing of the formation; and reducing the hydraulic pressure on the formation, whereby the small flow conduits are held open by propping agent particles.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
3 June 2004 (03.06.2004)

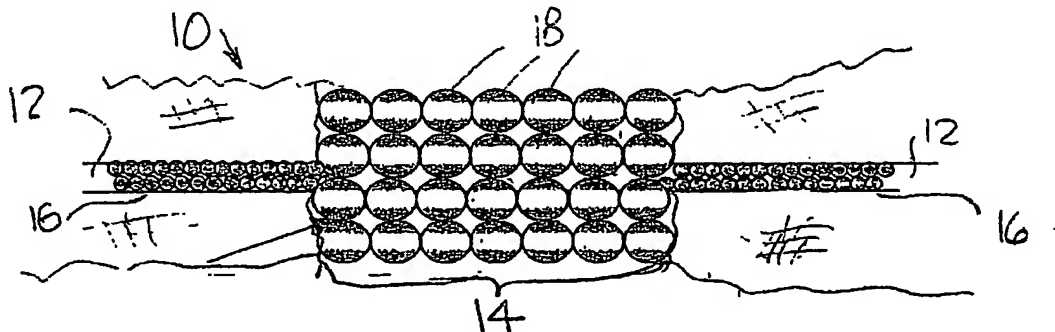
PCT

(10) International Publication Number
WO 2004/046495 A3

- (51) International Patent Classification⁷: **E21B 43/267**
- (21) International Application Number:
PCT/US2003/037252
- (22) International Filing Date:
18 November 2003 (18.11.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/427,134 18 November 2002 (18.11.2002) US
- (71) Applicant (for all designated States except US): **SAUDI ARABIAN OIL COMPANY [SA/SA]**; R-3296, Administration Building, Dhahran 31311 (SA).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **ORTIZ, Isaias** [US/SA]; 101 Banyan Court, Dhahran 31311 (SA). **THOMAS, Ronnie, L.** [US/SA]; 100 Cactus CT, Dhahran 31311 (SA).
- (74) Agent: **SPATH, Thomas, E.**; Abelman, Frayne & Schwab, 150 East 42nd Street, New York, NY 10017-5612 (US).
- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (*regional*): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:
— with international search report
- (88) Date of publication of the international search report:
31 March 2005

[Continued on next page]

(54) Title: METHOD OF TREATING SUBTERRANEAN FORMATIONS TO ENHANCE HYDROCARBON PRODUCTION USING PROPPANTS



(57) Abstract: A method of enhancing the flow of hydrocarbon fluids from small flow conduits (12) in a subterranean reservoir rock formation (10) that have traditionally not been propped in association with a fracturing treatment of the formation (10), the method including the steps of introducing a first pressurized fluid into the formation at a pressure that is sufficient to expand the pre-existing small flow conduits (12) and introducing into the pressure-expanded small flow conduits (12) a first portion of a relatively small particulate propping agent (16); simultaneously with the fracturing of the formation, or immediately thereafter, introducing a second portion of a relatively small particulate propping agent (16) into expanded pre-existing small flow conduits and into any new small flow conduits that are formed by the fracturing of the formation; and reducing the hydraulic pressure on the formation, whereby the small flow conduits are held open by propping agent particles.

WO 2004/046495 A3



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/37252

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : E21B 43/267

US CL : 166?308.1

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 166?308.1,307,308.3,280.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,105,886 A (STRUBHAR et al) 21 April 1992 (21/04/92), see entire document.	1,2
---		-----
Y		3
Y	US 6,342,467 B1 (CHANG et al) 29 January 2002 (29/01/02), see entire document.	3

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:		"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier application or patent published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

30 June 2004 (30.06.2004)

Date of mailing of the international search report

04 OCT 2004

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Facsimile No. (703)305-3230

Authorized officer

William P Neuder *W Neuder*
Telephone No. 703-308-2168

INTERNATIONAL SEARCH REPORT

PCT/US03/37252

Continuation of B. FIELDS SEARCHED Item 3:

EAST

search terms fracturing, propping